



General

Guideline Title

KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease.

Bibliographic Source(s)

KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease. *Kidney Int Suppl.* 2013 Jan;3(1):1-150. [729 references]

Guideline Status

This is the current release of the guideline.

Regulatory Alert

FDA Warning/Regulatory Alert

Note from the National Guideline Clearinghouse: This guideline references a drug(s) for which important revised regulatory and/or warning information has been released.

- [April 8, 2016 – Metformin-containing Drugs](#) : The U.S. Food and Drug Administration (FDA) is requiring labeling changes regarding the recommendations for metformin-containing medicines for diabetes to expand metformin's use in certain patients with reduced kidney function. The current labeling strongly recommends against use of metformin in some patients whose kidneys do not work normally. FDA concluded, from the review of studies published in the medical literature, that metformin can be used safely in patients with mild impairment in kidney function and in some patients with moderate impairment in kidney function.

Recommendations

Major Recommendations

Definitions of the strength of recommendation (Level 1, Level 2, or Not Graded) and the quality of the supporting evidence (A-D) are provided at the end of the "Major Recommendations" field.

Definition and Classification of Chronic Kidney Disease (CKD)

Definition of CKD

- CKD is defined as abnormalities of kidney structure or function, present for >3 months, with implications for health. (Not Graded)

Table. Criteria for CKD (Either of the Following Present for >3 Months)

Markers of kidney damage (one or more)	<ul style="list-style-type: none"> • Albuminuria (albumin excretion rate [AER] ≥ 30 mg/24 hours; albumin-to-creatinine ratio [ACR] ≥ 30 mg/g [≥ 3 mg/mmol]) • Urine sediment abnormalities • Electrolyte and other abnormalities due to tubular disorders • Abnormalities detected by histology • Structural abnormalities detected by imaging • History of kidney transplantation
Decreased glomerular filtration rate (GFR)	GFR < 60 ml/min/1.73 m ² (GFR categories G3a–G5)

Staging of CKD

- The Work Group recommends that CKD is classified based on cause, GFR category, and albuminuria category (CGA). (1B)
- Assign cause of CKD based on presence or absence of systemic disease and the location within the kidney of observed or presumed pathologic-anatomic findings. (Not Graded)
- Assign GFR categories as follows (Not Graded):

Table. GFR Categories in CKD

GFR Category	GFR (ml/min/1.73 m ²)	Terms
G1	≥ 90	Normal or high
G2	60–89	Mildly decreased*
G3a	45–59	Mildly to moderately decreased
G3b	30–44	Moderately to severely decreased
G4	15–29	Severely decreased
G5	< 15	Kidney failure

*Relative to young adult level.

In the absence of evidence of kidney damage, neither GFR category G1 nor G2 fulfill the criteria for CKD.

- Assign albuminuria* categories as follows (Not Graded):

*Note that where albuminuria measurement is not available, urine reagent strip results can be substituted (see Table 7 in the original guideline document.)

Table. Albuminuria Categories in CKD

Category	AER (mg/24 hours)	ACR (approximate equivalent)		Terms
		(mg/mmol)	(mg/g)	
A1	< 30	< 3	< 30	Normal to mildly increased
A2	30–300	3–30	30–300	Moderately increased*
A3	> 300	> 30	> 300	Severely increased**

*Relative to young adult level.

**Including nephrotic syndrome (albumin excretion usually >2200 mg/24 hours [ACR >2220 mg/g; >220 mg/mmol]).

Predicting Prognosis of CKD

- In predicting risk for outcome of CKD, identify the following variables: 1) cause of CKD; 2) GFR category; 3) albuminuria category; 4) other risk factors and comorbid conditions. (Not Graded)
- In people with CKD, use estimated risk of concurrent complications and future outcomes to guide decisions for testing and treatment for CKD complications. (Not Graded)
- In populations with CKD, group GFR and albuminuria categories with similar relative risk for CKD outcomes into risk categories. (Not Graded)

See Figure 9 in the original guideline document.

Evaluation of CKD

Evaluation of Chronicity

- In people with GFR <60 ml/min/1.73 m² (GFR categories G3a–G5) or markers of kidney damage, review past history and previous measurements to determine duration of kidney disease. (Not Graded)
 - If duration is >3 months, CKD is confirmed. Follow recommendations for CKD.
 - If duration is not >3 months or unclear, CKD is not confirmed. Patients may have CKD or acute kidney diseases (including acute kidney injury [AKI]) or both and tests should be repeated accordingly.

Evaluation of Cause

- Evaluate the clinical context, including personal and family history, social and environmental factors, medications, physical examination, laboratory measures, imaging, and pathologic diagnosis to determine the causes of kidney disease. (Not Graded)

Evaluation of GFR

- The Work Group recommends using serum creatinine and a GFR estimating equation for initial assessment. (1A)
- The Work Group suggests using additional tests (such as cystatin C or a clearance measurement) for confirmatory testing in specific circumstances when estimated GFR (eGFR) based on serum creatinine is less accurate. (2B)
- The Work Group recommends that clinicians (1B):
 - Use a GFR estimating equation to derive GFR from serum creatinine (eGFR_{creat}) rather than relying on the serum creatinine concentration alone.
 - Understand clinical settings in which eGFR_{creat} is less accurate.
- The Work Group recommends that clinical laboratories should (1B):
 - Measure serum creatinine using a specific assay with calibration traceable to the international standard reference materials and minimal bias compared to isotope-dilution mass spectrometry (IDMS) reference methodology.
 - Report eGFR_{creat} in addition to the serum creatinine concentration in adults and specify the equation used whenever reporting eGFR_{creat}.
 - Report eGFR_{creat} in adults using the 2009 CKD-Epidemiology Collaboration (EPI) creatinine equation. An alternative creatinine-based GFR estimating equation is acceptable if it has been shown to improve accuracy of GFR estimates compared to the 2009 CKD-EPI creatinine equation.
- When reporting serum creatinine:
 - The Work Group recommends that serum creatinine concentration be reported and rounded to the nearest whole number when expressed as standard international units (μmol/l) and rounded to the nearest 100th of a whole number when expressed as conventional units (mg/dl).
- When reporting eGFR_{creat}:
 - The Work Group recommends that eGFR_{creat} should be reported and rounded to the nearest whole number and relative to a body surface area of 1.73 m² in adults using the units ml/min/1.73 m².
 - The Work Group recommends eGFR_{creat} levels less than 60 ml/min/1.73 m² should be reported as "decreased."

- The Work Group suggests measuring cystatin C in adults with $\text{eGFR}_{\text{creat}} 45\text{--}59 \text{ ml/min/1.73 m}^2$ who do not have markers of kidney damage if confirmation of CKD is required. (2C)
 - If $\text{eGFR}_{\text{cys}}/\text{eGFR}_{\text{creat-cys}}$ is also $<60 \text{ ml/min/1.73 m}^2$, the diagnosis of CKD is confirmed.
 - If $\text{eGFR}_{\text{cys}}/\text{eGFR}_{\text{creat-cys}}$ is $\geq 60 \text{ ml/min/1.73 m}^2$, the diagnosis of CKD is not confirmed.
- If cystatin C is measured, the Work Group suggests that health professionals (2C):
 - Use a GFR estimating equation to derive GFR from serum cystatin C rather than relying on the serum cystatin C concentration alone.
 - Understand clinical settings in which eGFR_{cys} and $\text{eGFR}_{\text{creat-cys}}$ are less accurate.
- The Work Group recommends that clinical laboratories that measure cystatin C should (1B):
 - Measure serum cystatin C using an assay with calibration traceable to the international standard reference material.
 - Report eGFR from serum cystatin C in addition to the serum cystatin C concentration in adults and specify the equation used whenever reporting eGFR_{cys} and $\text{eGFR}_{\text{creat-cys}}$.
 - Report eGFR_{cys} and $\text{eGFR}_{\text{creat-cys}}$ in adults using the 2012 CKD-EPI cystatin C and 2012 CKD-EPI creatinine-cystatin C equations, respectively, or alternative cystatin C-based GFR estimating equations if they have been shown to improve accuracy of GFR estimates compared to the 2012 CKD-EPI cystatin C and 2012 CKD-EPI creatinine-cystatin C equations.
- When reporting serum cystatin C:
 - The Work Group recommends reporting serum cystatin C concentration rounded to the nearest 100th of a whole number when expressed as conventional units (mg/l).
- When reporting eGFR_{cys} and $\text{eGFR}_{\text{creat-cys}}$:
 - The Work Group recommends that eGFR_{cys} and $\text{eGFR}_{\text{creat-cys}}$ be reported and rounded to the nearest whole number and relative to a body surface area of 1.73 m^2 in adults using the units ml/min/1.73 m^2 .
 - The Work Group recommends eGFR_{cys} and $\text{eGFR}_{\text{creat-cys}}$ levels less than $60 \text{ ml/min/1.73 m}^2$ should be reported as "decreased."
- The Work Group suggests measuring GFR using an exogenous filtration marker under circumstances where more accurate ascertainment of GFR will impact on treatment decisions. (2B)

Evaluation of Albuminuria

- The Work Group suggests using the following measurements for initial testing of proteinuria (in descending order of preference, in all cases an early morning urine sample is preferred) (2B):
 1. Urine albumin-to-creatinine ratio (ACR)
 2. Urine protein-to-creatinine ratio (PCR)
 3. Reagent strip urinalysis for total protein with automated reading
 4. Reagent strip urinalysis for total protein with manual reading
- The Work Group recommends that clinical laboratories report ACR and PCR in untimed urine samples in addition to albumin concentration or proteinuria concentrations rather than the concentrations alone. (1B)
 - The term microalbuminuria should no longer be used by laboratories. (Not Graded)
- Clinicians need to understand settings that may affect interpretation of measurements of albuminuria and order confirmatory tests as indicated (Not Graded):
 - Confirm reagent strip positive albuminuria and proteinuria by quantitative laboratory measurement and express as a ratio to creatinine wherever possible.
 - Confirm $\text{ACR} \geq 30 \text{ mg/g}$ ($\geq 3 \text{ mg/mmol}$) on a random untimed urine sample with a subsequent early morning urine sample.
 - If a more accurate estimate of albuminuria or total proteinuria is required, measure albumin excretion rate (AER) or total protein excretion rate (PER) in a timed urine sample.
- If significant non-albumin proteinuria is suspected, use assays for specific urine proteins (e.g., α_1 -microglobulin, monoclonal heavy or light chains [known in some countries as "Bence Jones" proteins]). (Not Graded)

Definition, Identification, and Prediction of CKD Progression

Definition and Identification of CKD Progression

- Assess GFR and albuminuria at least annually in people with CKD. Assess GFR and albuminuria more often for individuals at higher risk of progression, and/or where measurement will impact therapeutic decisions (see Figure 17 in the original guideline document). (Not Graded)
- Recognize that small fluctuations in GFR are common and are not necessarily indicative of progression. (Not Graded)
- Define CKD progression based on one or more of the following (Not Graded):

- Decline in GFR category (≥ 90 [G1], 60–89 [G2], 45–59 [G3a], 30–44 [G3b], 15–29 [G4], <15 [G5] ml/min/1.73 m²). A certain drop in eGFR is defined as a drop in GFR category accompanied by a 25% or greater drop in eGFR from baseline.
- Rapid progression is defined as a sustained decline in eGFR of more than 5 ml/min/1.73 m²/yr.
- The confidence in assessing progression is increased with increasing number of serum creatinine measurements and duration of follow-up.
- In people with CKD progression, as defined above, review current management, examine for reversible causes of progression, and consider referral to a specialist. (Not Graded)

Predictors of Progression

- Identify factors associated with CKD progression to inform prognosis. These include cause of CKD, level of GFR, level of albuminuria, age, sex, race/ethnicity, elevated blood pressure (BP), hyperglycemia, dyslipidemia, smoking, obesity, history of cardiovascular disease, ongoing exposure to nephrotoxic agents, and others. (Not Graded)

Management of Progression and Complications of CKD

Prevention of CKD Progression

BP and Renin-Angiotensin-Aldosterone System (RAAS) Interruption

- Individualize BP targets and agents according to age, coexistent cardiovascular disease and other comorbidities, risk of progression of CKD, presence or absence of retinopathy (in CKD patients with diabetes), and tolerance of treatment as described in the National Guideline Clearinghouse (NGC) summary of the [KDIGO clinical practice guideline for the management of blood pressure in chronic kidney disease](#). (Not Graded)
- Inquire about postural dizziness and check for postural hypotension regularly when treating CKD patients with BP-lowering drugs. (Not Graded)
- Tailor BP treatment regimens in elderly patients with CKD by carefully considering age, comorbidities and other therapies, with gradual escalation of treatment and close attention to adverse events related to BP treatment, including electrolyte disorders, acute deterioration in kidney function, orthostatic hypotension and drug side effects. (Not Graded)
- The Work Group recommends that in both diabetic and non-diabetic adults with CKD and urine albumin excretion <30 mg/24 hours (or equivalent*) whose office BP is consistently >140 mm Hg systolic or >90 mm Hg diastolic be treated with BP-lowering drugs to maintain a BP that is consistently ≤ 140 mm Hg systolic and ≤ 90 mm Hg diastolic. (1B)
- The Work Group suggests that in both diabetic and non-diabetic adults with CKD and with urine albumin excretion of ≥ 30 mg/24 hours (or equivalent*) whose office BP is consistently >130 mm Hg systolic or >80 mm Hg diastolic be treated with BP-lowering drugs to maintain a BP that is consistently ≤ 130 mm Hg systolic and ≤ 80 mm Hg diastolic. (2D)
- The Work Group suggests that an angiotensin receptor blocker (ARB) or angiotensin-converting enzyme-inhibitor (ACE-I) be used in diabetic adults with CKD and urine albumin excretion 30–300 mg/24 hours (or equivalent*). (2D)
- The Work Group recommends that an ARB or ACE-I be used in both diabetic and non-diabetic adults with CKD and urine albumin excretion >300 mg/24 hours (or equivalent*). (1B)
- There is insufficient evidence to recommend combining an ACE-I with ARBs to prevent progression of CKD. (Not Graded)
- The Work Group recommends that in children with CKD, BP-lowering treatment is started when BP is consistently above the 90th percentile for age, sex, and height. (1C)
- The Work Group suggests that in children with CKD (particularly those with proteinuria), BP is lowered to consistently achieve systolic and diastolic readings less than or equal to the 50th percentile for age, sex, and height, unless achieving these targets is limited by signs or symptoms of hypotension. (2D)
- The Work Group suggests that an ARB or ACE-I be used in children with CKD in whom treatment with BP-lowering drugs is indicated, irrespective of the level of proteinuria. (2D)

*Approximate equivalents for AER per 24 hours, expressed as PER per 24 hours, ACR, PCR, and protein reagent strip results, are given in the table titled "Albuminuria Categories in CKD" above.

CKD and Risk of AKI

- The Work Group recommends that all people with CKD are considered to be at increased risk of AKI. (1A)
 - In people with CKD, the recommendations detailed in the NGC summary of the [KDIGO clinical practice guideline for acute kidney injury](#) should be followed for management of those at risk of AKI during intercurrent illness, or when undergoing investigation and procedures that are likely to increase the risk of AKI. (Not Graded)

Protein Intake

- The Work Group suggests lowering protein intake to 0.8 g/kg/day in adults with diabetes (2C) or without diabetes (2B) and GFR <30 ml/min/1.73 m² (GFR categories G4–G5), with appropriate education.
- The Work Group suggests avoiding high protein intake (>1.3 g/kg/day) in adults with CKD at risk of progression. (2C)

Glycemic Control

- The Work Group recommends a target hemoglobin A_{1c} (HbA_{1c}) of ~7.0% (53 mmol/mol) to prevent or delay progression of the microvascular complications of diabetes, including diabetic kidney disease. (1A)
- The Work Group recommends not treating to an HbA_{1c} target of <7.0% (<53 mmol/mol) in patients at risk of hypoglycemia. (1B)
- The Work Group suggests that target HbA_{1c} be extended above 7.0% (53 mmol/mol) in individuals with comorbidities or limited life expectancy and risk of hypoglycemia. (2C)
- In people with CKD and diabetes, glycemic control should be part of a multifactorial intervention strategy addressing blood pressure control and cardiovascular risk, promoting the use of angiotensin-converting enzyme inhibition or angiotensin receptor blockade, statins, and antiplatelet therapy where clinically indicated. (Not Graded)

Salt Intake

- The Work Group recommends lowering salt intake to <90 mmol (<2 g) per day of sodium (corresponding to 5 g of sodium chloride) in adults, unless contraindicated (see rationale to this recommendation in the original guideline document). (1C)
 - The Work Group recommends restriction of sodium intake for children with CKD who have hypertension (systolic and/or diastolic blood pressure >95th percentile) or prehypertension (systolic and/or diastolic blood pressure >90th percentile and <95th percentile), following the age-based Recommended Daily Intake. (1C)
 - The Work Group recommends supplemental free water and sodium supplements for children with CKD and polyuria to avoid chronic intravascular depletion and to promote optimal growth. (1C)

Hyperuricemia

- There is insufficient evidence to support or refute the use of agents to lower serum uric acid concentrations in people with CKD and either symptomatic or asymptomatic hyperuricemia in order to delay progression of CKD. (Not Graded)

Lifestyle

- The Work Group recommends that people with CKD be encouraged to undertake physical activity compatible with cardiovascular health and tolerance (aiming for at least 30 minutes 5 times per week), achieve a healthy weight (body mass index [BMI] 20–25, according to country specific demographics), and stop smoking. (1D)

Additional Dietary Advice

- The Work Group recommends that individuals with CKD receive expert dietary advice and information in the context of an education program, tailored to severity of CKD and the need to intervene on salt, phosphate, potassium, and protein intake where indicated. (1B)

Complications Associated with Loss of Kidney Function

Definition and Identification of Anemia in CKD

- Diagnose anemia in adults and children >15 years with CKD when the hemoglobin (Hb) concentration is <13.0 g/dl (<130 g/l) in males and <12.0 g/dl (<120 g/l) in females. (Not Graded)
- Diagnose anemia in children with CKD if Hb concentration is <11.0 g/dl (<110 g/l) in children 0.5–5 years, <11.5 g/dl (115 g/l) in children 5–12 years, and <12.0 g/dl (120 g/l) in children 12–15 years. (Not Graded)

Evaluation of Anemia in People with CKD

- To identify anemia in people with CKD measure Hb concentration (Not Graded):
 - When clinically indicated in people with GFR ≥60 ml/min/1.73 m² (GFR categories G1–G2)
 - At least annually in people with GFR 30–59 ml/min/1.73 m² (GFR categories G3a–G3b)
 - At least twice per year in people with GFR <30 ml/min/1.73 m² (GFR categories G4–G5)

CKD Metabolic Bone Disease Including Laboratory Abnormalities

- The Work Group recommends measuring serum levels of calcium, phosphate, parathyroid hormone (PTH), and alkaline phosphatase activity at least once in adults with GFR <45 ml/min/1.73 m² (GFR categories G3b–G5) in order to determine baseline values and inform prediction equations if used. (1C)
- The Work Group suggests not to perform bone mineral density testing routinely in those with eGFR <45 ml/min/1.73 m² (GFR categories G3b–G5), as information may be misleading or unhelpful. (2B)
- In people with GFR <45 ml/min/1.73 m² (GFR categories G3b–G5), the Work Group suggests maintaining serum phosphate concentrations in the normal range according to local laboratory reference values. (2C)
- In people with GFR <45 ml/min/1.73 m² (GFR categories G3b–G5) the optimal PTH level is not known. The Work Group suggests that people with levels of intact PTH above the upper normal limit of the assay are first evaluated for hyperphosphatemia, hypocalcemia, and vitamin D deficiency. (2C)

Vitamin D Supplementation and Bisphosphonates in People with CKD

- The Work Group suggests not to routinely prescribe vitamin D supplements or vitamin D analogs, in the absence of suspected or documented deficiency, to suppress elevated PTH concentrations in people with CKD not on dialysis. (2B)
- The Work Group suggests not to prescribe bisphosphonate treatment in people with GFR <30 ml/min/1.73 m² (GFR categories G4–G5) without a strong clinical rationale. (2B)

Acidosis

- The Work Group suggests that in people with CKD and serum bicarbonate concentrations <22 mmol/l treatment with oral bicarbonate supplementation be given to maintain serum bicarbonate within the normal range, unless contraindicated. (2B)

Other Complications of CKD: Cardiovascular Disease (CVD), Medication Dosage, Patient Safety, Infections, Hospitalizations, and Caveats for Investigating Complications of CKD

CKD and CVD

- The Work Group recommends that all people with CKD be considered at increased risk for CVD. (1A)
- The Work Group recommends that the level of care for ischemic heart disease offered to people with CKD should not be prejudiced by their CKD. (1A)
- The Work Group suggests that adults with CKD at risk for atherosclerotic events be offered treatment with antiplatelet agents unless there is an increased bleeding risk that needs to be balanced against the possible cardiovascular benefits. (2B)
- The Work Group suggests that the level of care for heart failure offered to people with CKD should be the same as is offered to those without CKD. (2A)
- In people with CKD and heart failure, any escalation in therapy and/or clinical deterioration should prompt monitoring of eGFR and serum potassium concentration. (Not Graded)

Caveats When Interpreting Tests for CVD in People with CKD

B-type Natriuretic Peptide (BNP)/N-terminal proBNP (NT-proBNP)

- In people with GFR <60 ml/min/1.73 m² (GFR categories G3a–G5), the Work Group recommends that serum concentrations of BNP/NT-proBNP be interpreted with caution and in relation to GFR with respect to diagnosis of heart failure and assessment of volume status. (1B)

Troponins

- In people with GFR <60 ml/min/1.73 m² (GFR categories G3a–G5), the Work Group recommends that serum concentrations of troponin be interpreted with caution with respect to diagnosis of acute coronary syndrome. (1B)

Non-invasive Testing

- The Work Group recommends that people with CKD presenting with chest pain should be investigated for underlying cardiac disease and other disorders according to the same local practice for people without CKD (and subsequent treatment should be initiated similarly). (1B)
- The Work Group suggests that clinicians are familiar with the limitations of non-invasive cardiac tests (e.g., exercise electrocardiography [ECG], nuclear imaging, echocardiography, etc.) in adults with CKD and interpret the results accordingly. (2B)

CKD and Peripheral Arterial Disease

- The Work Group recommends that adults with CKD be regularly examined for signs of peripheral arterial disease and be considered for usual approaches to therapy. (1B)
- The Work Group suggests that adults with CKD and diabetes are offered regular podiatric assessment. (2A)

Medication Management and Patient Safety in CKD

- The Work Group recommends that prescribers should take GFR into account when drug dosing. (1A)
- Where precision is required for dosing (due to narrow therapeutic or toxic range) and/or estimates may be unreliable (e.g., due to low muscle mass), the Work Group recommends methods based upon cystatin C or direct measurement of GFR. (1C)
- The Work Group recommends temporary discontinuation of potentially nephrotoxic and renally excreted drugs in people with a GFR <60 ml/min/1.73 m² (GFR categories G3a–G5) who have serious intercurrent illness that increases the risk of AKI. These agents include, but are not limited to: RAAS blockers (including ACE-Is, ARBs, aldosterone inhibitors, direct renin inhibitors), diuretics, non-steroidal anti-inflammatory drugs (NSAIDs), metformin, lithium, and digoxin. (1C)
- The Work Group recommends that adults with CKD seek medical or pharmacist advice before using over-the-counter medicines or nutritional protein supplements. (1B)
- The Work Group recommends not using herbal remedies in people with CKD. (1B)
- The Work Group recommends that metformin be continued in people with GFR ≥45 ml/min/1.73 m² (GFR categories G1–G3a); its use should be reviewed in those with GFR 30–44 ml/min/1.73 m² (GFR category G3b); and it should be discontinued in people with GFR <30 ml/min/1.73 m² (GFR categories G4–G5). (1C)
- The Work Group recommends that all people taking potentially nephrotoxic agents such as lithium and calcineurin inhibitors should have their GFR, electrolytes and drug levels regularly monitored. (1A)
- People with CKD should not be denied therapies for other conditions such as cancer but there should be appropriate dose adjustment of cytotoxic drugs according to knowledge of GFR. (Not Graded)

Imaging Studies

- Balance the risk of acute impairment in kidney function due to contrast agent use against the diagnostic value and therapeutic implications of the investigation. (Not Graded)

Radioccontrast

- The Work Group recommends that all people with GFR <60 ml/min/1.73 m² (GFR categories G3a–G5) undergoing elective investigation involving the intravascular administration of iodinated radioccontrast media should be managed according to the NGC summary of the [KDIGO clinical practice guideline for acute kidney injury](#):
 - Avoidance of high osmolar agents (1B)
 - Use of lowest possible radioccontrast dose (Not Graded)
 - Withdrawal of potentially nephrotoxic agents before and after the procedure (1C)
 - Adequate hydration with saline before, during, and after the procedure (1A)
 - Measurement of GFR 48–96 hours after the procedure (1C)

Gadolinium-based Contrast Media

- The Work Group recommends not using gadolinium-containing contrast media in people with GFR <15 ml/min/1.73 m² (GFR category G5) unless there is no alternative appropriate test. (1B)
- The Work Group suggests that people with a GFR <30 ml/min/1.73 m² (GFR categories G4–G5) who require gadolinium-containing contrast media are preferentially offered a macrocyclic chelate preparation. (2B)

Bowel Preparation

- The Work Group recommends not to use oral phosphate-containing bowel preparations in people with a GFR <60 ml/min/1.73 m² (GFR categories G3a–G5) or in those known to be at risk of phosphate nephropathy. (1A)

CKD and Risk of Infections, AKI, Hospitalizations, and Mortality

CKD and Risk of Infections

- The Work Group recommends that all adults with CKD are offered annual vaccination with influenza vaccine, unless contraindicated. (1B)
- The Work Group recommends that all adults with eGFR <30 ml/min/1.73 m² (GFR categories G4–G5) and those at high risk of pneumococcal infection (e.g., nephrotic syndrome, diabetes, or those receiving immunosuppression) receive vaccination with polyvalent pneumococcal vaccine unless contraindicated. (1B)
- The Work Group recommends that all adults with CKD who have received pneumococcal vaccination are offered revaccination within 5 years. (1B)
- The Work Group recommends that all adults who are at high risk of progression of CKD and have GFR <30 ml/min/1.73 m² (GFR categories G4–G5) be immunized against hepatitis B and the response confirmed by appropriate serological testing. (1B)
- Consideration of live vaccine should include an appreciation of the patient's immune status and should be in line with recommendations from official or governmental bodies. (Not Graded)
- Pediatric immunization schedules should be followed according to official international and regional recommendations for children with CKD. (Not Graded)

CKD and Risk of AKI

- The Work Group recommends that all people with CKD are considered to be at increased risk of AKI. (1A)
 - In people with CKD, the recommendations detailed in the NGC summary of the KDIGO clinical practice guideline for acute kidney injury should be followed for management of those at risk of AKI during intercurrent illness, or when undergoing investigation and procedures that are likely to increase the risk of AKI. (Not Graded)

CKD and Risk of Hospitalization and Mortality

- CKD management programs should be developed in order to optimize the community management of people with CKD and reduce the risk of hospital admission. (Not Graded)
- Interventions to reduce hospitalization and mortality for people with CKD should pay close attention to the management of associated comorbid conditions and CVD in particular. (Not Graded)

Referral to Specialists and Models of Care

Referral to Specialist Services

- The Work Group recommends referral to specialist kidney care services for people with CKD in the following circumstances (1B):
 - AKI or abrupt sustained fall in GFR
 - GFR <30 ml/min/1.73 m² (GFR categories G4–G5)*
 - A consistent finding of significant albuminuria (ACR ≥300 mg/g [≥30 mg/mmol] or AER ≥300 mg/24 hours, approximately equivalent to PCR ≥500 mg/g [≥50 mg/mmol] or PER ≥500 mg/24 hours)
 - Progression of CKD (see above for definition)
 - Urinary red cell casts, red blood cells (RBCs) >20 per high power field sustained and not readily explained
 - CKD and hypertension refractory to treatment with 4 or more antihypertensive agents
 - Persistent abnormalities of serum potassium
 - Recurrent or extensive nephrolithiasis
 - Hereditary kidney disease
- The Work Group recommends timely referral for planning renal replacement therapy (RRT) in people with progressive CKD in whom the risk of kidney failure within 1 year is 10% to 20% or higher†, as determined by validated risk prediction tools. (1B)

See Figure 21 in the original guideline document for information on referral decision making by GFR and albuminuria.

*If this is a stable isolated finding, formal referral (i.e., formal consultation and ongoing care management) may not be necessary and advice from specialist services may be all that is required to facilitate best care for the patients. This will be health-care system dependent.

†The aim is to avoid late referral, defined here as referral to specialist services less than 1 year before start of RRT.

Care of the Patient with Progressive CKD

- The Work Group suggests that people with progressive CKD should be managed in a multidisciplinary care setting. (2B)
- The multidisciplinary team should include or have access to dietary counseling, education and counseling about different RRT modalities, transplant options, vascular access surgery, and ethical, psychological, and social care. (Not Graded)

Timing the Initiation of RRT

- The Work Group suggests that dialysis be initiated when one or more of the following are present: symptoms or signs attributable to kidney failure (serositis, acid-base or electrolyte abnormalities, pruritus); inability to control volume status or blood pressure; a progressive deterioration in nutritional status refractory to dietary intervention; or cognitive impairment. This often but not invariably occurs in the GFR range between 5 and 10 ml/min/1.73 m². (2B)
- Living donor preemptive renal transplantation in adults should be considered when the GFR is <20 ml/min/1.73 m², and there is evidence of progressive and irreversible CKD over the preceding 6–12 months. (Not Graded)

Structure and Process of Comprehensive Conservative Management

- Conservative management should be an option in people who choose not to pursue RRT and this should be supported by a comprehensive management program. (Not Graded)
- All CKD programs and care providers should be able to deliver advance care planning for people with a recognized need for end-of-life care, including those people undergoing conservative kidney care. (Not Graded)
- Coordinated end-of-life care should be available to people and families through either primary care or specialist care as local circumstances dictate. (Not Graded)
- The comprehensive conservative management program should include protocols for symptom and pain management, psychological care, spiritual care, and culturally sensitive care for the dying patient and their family (whether at home, in a hospice or a hospital setting), followed by the provision of culturally appropriate bereavement support. (Not Graded)

Definitions:

Final Grade for Overall Quality of Evidence

Grade	Quality of Evidence	Meaning
A	High	The Work Group is confident that the true effect lies close to that of the estimate of the effect.
B	Moderate	The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
C	Low	The true effect may be substantially different from the estimate of the effect.
D	Very Low	The estimate of effect is very uncertain, and often will be far from the truth.

Nomenclature and Description for Grading Recommendations

	Implications		
Grade*	Patients	Clinicians	Policy
Level 1 'The Work Group recommends'	Most people in your situation would want the recommended course of action and only a small proportion would not.	Most patients should receive the recommended course of action.	The recommendation can be evaluated as a candidate for developing a policy or a performance measure.
Level 2 'The Work Group suggests'	The majority of people in your situation would want the recommended course of action, but many would not.	Different choices will be appropriate for different patients. Each patient needs help to arrive at a management decision consistent with her or his values and preferences.	The recommendation is likely to require debate and involvement of stakeholders before policy can be determined.

*The additional category 'Not Graded' was used, typically, to provide guidance based on common sense or where the topic does not allow adequate application of evidence. The most common examples include recommendations regarding monitoring intervals, counseling, and referral to other clinical specialists. The ungraded recommendations are generally written as simple declarative statements, but are not meant to be interpreted as being stronger recommendations than Level 1 or 2 recommendations.

Clinical Algorithm(s)

A suggested protocol for the further investigation of an individual demonstrating a positive reagent strip test for albuminuria/proteinuria or quantitative albuminuria/proteinuria test is available in the original guideline document.

Scope

Disease/Condition(s)

- Chronic kidney disease (CKD)
- Complications of CKD
 - Hypertension
 - Anemia
 - Metabolic bone disease
 - Acidosis
 - Cardiovascular disease (CVD)
 - Peripheral arterial disease

Guideline Category

Counseling

Diagnosis

Evaluation

Management

Prevention

Risk Assessment

Treatment

Clinical Specialty

Cardiology

Endocrinology

Geriatrics

Internal Medicine

Nephrology

Nutrition

Pediatrics

Intended Users

Advanced Practice Nurses

Allied Health Personnel

Health Care Providers

Nurses

Physician Assistants

Physicians

Guideline Objective(s)

- To develop an evidence-based clinical practice guideline for evaluation and management of chronic kidney disease (CKD)
- To update the *KDOQI Clinical Practice Guidelines for CKD: Evaluation, Classification, and Stratification* in 2002, which spans many topics related to the diagnosis, classification, stratification, and management of CKD
- To assist the practitioner caring for patients with CKD and to prevent deaths, cardiovascular disease events, and progression to kidney failure while optimizing patients' quality of life

Target Population

Adults and children identified with chronic kidney disease (CKD) who are not on renal replacement therapy (RRT) (i.e., not on dialysis or have not received a kidney transplant)

Note: It is beyond the scope of this guideline to address all issues related to children with CKD, given the heterogeneous nature of this group of individuals who range from newborn to post-adolescents, with specific physiological differences within each of those groups.

Interventions and Practices Considered

Diagnosis/Evaluation

1. Classification of chronic kidney disease (CKD) based on cause, glomerular filtration rate (GFR) category, and albuminuria category
2. Evaluation of chronicity, cause, and GFR:
 - Clinical context
 - Personal and family history
 - Social and environmental factors
 - Medications
 - Physical examination
 - Laboratory measures (serum creatinine, serum cystatin C)
 - Imaging
 - Pathologic diagnosis
 - GFR-estimating equation
3. Evaluation of albuminuria:
 - Urine albumin-to-creatinine ratio (ACR)
 - Urine protein-to-creatinine ratio (PCR)
 - Reagent strip urinalysis for total protein with automated or manual reading
4. Identification of CKD progression
5. Measuring hemoglobin (Hb) concentration for anemia
6. Measuring serum levels of calcium, phosphate, parathyroid hormone (PTH), alkaline phosphatase activity for metabolic bone disease
7. Testing for cardiovascular disease:
 - B-type natriuretic peptide (BNP)/N-terminal-proBNP (NT-proBNP)
 - Troponins
 - Imaging (exercise electrocardiography [ECG], nuclear imaging, echocardiography)
8. Monitoring for peripheral arterial disease
9. Podiatric assessment for diabetic patients

Treatment/Management/Prevention

1. Individualized blood pressure (BP) targets and agents
2. Assessment for postural dizziness or postural hypotension
3. Angiotensin receptor blockers (ARBs)
4. Angiotensin-converting enzyme-inhibitors (ACE-Is)
5. Lowering protein intake
6. Glycemic control (target hemoglobin A_{1c} [HbA_{1c}])
7. Statins
8. Antiplatelet therapy
9. Lowering salt intake
10. Physical activity
11. Achieving a healthy weight
12. Smoking cessation
13. Expert dietary advice
14. Bicarbonate supplementation as needed
15. Medication management:
 - Continuation/discontinuation of medications as needed
 - Monitoring of GFR, electrolytes, and drug levels
16. Caution with use of contrast agents and bowel preparations for imaging
17. Vaccinations/immunization
18. Referral to specialist services
19. Renal replacement therapy (dialysis, transplant)
20. Conservative management
21. Advance care planning
22. End-of-life and palliative care

Note: The following are considered but not recommended: agents to lower serum uric acid concentrations, bone mineral density measurement, vitamin D and bisphosphonate supplementation, herbal remedies.

Major Outcomes Considered

- Sensitivity, specificity, and accuracy of diagnostic tests
- Rates of chronic kidney disease (CKD) progression
- Risk of cardiovascular disease (CVD)
- Risk of end-stage renal disease (ESRD)
- Mortality
- Quality of life
- Risk of hypertension, gout attacks, and proteinuria

Methodology

Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Literature Searches and Article Selection for Evidence Review Topics

Search strategies were developed by the Evidence Review Team (ERT), with input from the Work Group, for each topic of interest (whether treatment or non-treatment topics). The ERT performed literature searches and conducted abstract and article screening. The ERT also coordinated the methodological and analytic processes, data extraction, and summarizing of the evidence. Before initiating the ERT's own *de novo* systematic review, the ERT searched for existing systematic reviews that could be used. The searches and search terms are provided in

Supplemental Table 1 (see the "Availability of Companion Documents" field) and the search dates and yields for all topics are presented in Table 38 of the original guideline document. The search was updated through June 2011 and supplemented by articles identified by Work Group members through November 2012.

Selection of Outcomes of Interest

The Work Group selected outcomes of interest on the basis of their importance for informing clinical decision making. Importance of mortality and end-stage renal disease (ESRD) was considered to be critical; the importance of progression of chronic kidney disease (CKD) and categorical or continuous measures of kidney function was considered to be high; and the importance of quality of life (QOL), blood pressure (BP), gout attacks, and proteinuria was considered to be moderate.

Limitations of Approach

Although the literature searches were intended to be comprehensive, they were not exhaustive. MEDLINE was the only database searched. Hand searches of journals were not performed, and review articles and textbook chapters were not systematically searched. However, important studies known to domain experts that were missed by the electronic literature searches were added to the retrieved articles and reviewed by the Work Group.

Number of Source Documents

Twenty-three primary articles were included. See Table 38 in the original guideline document for literature yield of primary articles for all topics.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Grading of Recommendations Assessment, Development and Evaluation (GRADE) System for Grading Quality of Evidence for an Outcome

Step 1: Starting Grade for Quality of Evidence Based on Study Design	
Randomized trials	High
Observational study	Low
Any other evidence	Very low
Step 2: Reduce Grade	
Study quality	-1 level if serious limitations -2 levels if very serious limitations
Consistency	-1 level if important inconsistency
Directness	-1 level if some uncertainty -2 levels if major uncertainty
Other	-1 level if sparse or imprecise data ^c -1 level if high probability of reporting bias
Step 3: Raise Grade	
Strength of association	+1 level if strong ^a no plausible confounders +2 levels if very strong ^b no major threats to validity
Other	+1 level if evidence of a dose-response gradient +1 level if all residual plausible confounders would have reduced the observed effect

Final Grade for Quality of Evidence and Definition	
High	Further research is unlikely to change confidence in the estimate of the effect.
Moderate	Further research is likely to have an important impact on confidence in the estimate of effect, and may change the estimate.
Low	Further research is very likely to have an important impact on confidence in the estimate, and may change the estimate.
Very low	Any estimate of effect is very uncertain.

^aStrong evidence of association is defined as 'significant relative risk (RR) of >2 (<0.5)' based on consistent evidence from two or more observational studies, with no plausible confounders.

^bVery strong evidence of association is defined as 'significant RR of >5 (<0.2)' based on direct evidence with no major threats to validity.

^cSparse if there is only one study or if total N <100. Imprecise if there is a low event rate (0 or 1 event) in either arm or confidence interval spanning a range <0.5 to >2.0.

Adapted by permission from Macmillan Publishers Ltd, *Kidney International*. Uhlig et al. Grading evidence and recommendations for clinical practice guidelines in nephrology. A position statement from Kidney Disease: Improving Global Outcomes (KDIGO). *Kidney Int* 2006; 70: 2058–2065.

Final Grade for Overall Quality of Evidence

Grade	Quality of Evidence	Meaning
A	High	The Work Group is confident that the true effect lies close to that of the estimate of the effect.
B	Moderate	The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
C	Low	The true effect may be substantially different from the estimate of the effect.
D	Very Low	The estimate of effect is very uncertain, and often will be far from the truth.

Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

Data Extraction

Text articles were extracted by the Evidence Review Team (ERT) onto forms customized to capture data on design, methodology, baseline characteristics, interventions or predictors, comparators, outcomes, results, and limitations of individual studies. Study methodology and risk of bias were also systematically graded for each outcome and recorded.

Summary Tables

Pertinent information for systematic review topics was tabulated in summary tables. Summary tables list outcomes of interest as well as relevant population characteristics, descriptions of interventions and comparators, results, and quality grades for each outcome. Categorical and continuous outcomes were summarized separately. Work Group members reviewed all summary table data and quality grades.

Evidence Profiles

Evidence profiles are usually constructed as a means to assess the quality and record quality grades and descriptions of effect for each outcome

across studies, as well as the quality grades and description of net benefits or harms of the intervention or comparator across studies. These profiles aim to make the evidence synthesis process transparent. However, since no treatment or non-treatment topic had more than one study in a summary table for which the quality was graded, no evidence profiles were generated, and the information in the summary table shows the highest level of synthesis.

Grading of Quality of Evidence for Outcomes of Individual Studies

Methodological quality (internal validity) refers to the design, conduct, and reporting of outcomes of a clinical study. A previously devised three-level classification system for quality assessment was used to grade the overall study quality and quality of all relevant outcomes in the study (see Table 39 in the original guideline document). Variations of this system have been used in most Kidney Disease Outcomes Quality Initiative (KDOQI) and all Kidney Disease: Improving Global Outcomes (KDIGO) guidelines and have been recommended for the US Agency for Healthcare Research and Quality Evidence-based Practice Center program.

Each study was given an overall quality grade on the basis of its design, methodology (randomization, allocation, blinding, definition of outcomes, appropriate use of statistical methods, etc.), conduct (drop-out percentage, outcome assessment methodologies, etc.), and reporting (internal consistency, clarity, thoroughness, and precision, etc.). Each reported outcome was then evaluated and given an individual grade depending on the quality of reporting and methodological issues specific to that outcome. However, the quality grade of an individual outcome could not exceed the quality grade for the overall study.

Grading the Quality of Evidence and the Strength of Guideline Recommendations

A structured approach, based on the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach, was used to grade the quality of the overall evidence and the strength of recommendations for each topic. This grading scheme with two levels for the strength of a recommendation together with four levels of grading for the quality of the evidence, as well as the option of an ungraded statement for general guidance was adopted by the KDIGO Board in December 2008.

The quality of a body of evidence refers to the extent to which the Work Group's confidence in an estimate of effect is sufficient to support a particular recommendation. The process of transparently grading evidence and recommendations for treatment topics is described below in further detail. However, the approach had to be adapted for the main topics of the KDIGO chronic kidney disease (CKD) guideline because they were not treatment-related topics.

Grading the Quality of Evidence for Each Outcome Across Studies

Following the GRADE approach, the quality of a body of evidence pertaining to a particular outcome of interest was initially categorized on the basis of study design (see Table 40 in the original guideline document). For questions of interventions, the initial quality grade was high if the body of evidence consisted of randomized controlled trials (RCTs), low if it consisted of observational studies, and very low if it consisted of studies of other designs. For questions of interventions, the Work Group decided to use only RCTs. The grade for the quality of evidence for each intervention–outcome pair was then lowered if there were serious limitations to the methodological quality of the aggregate of studies, if there was thought to be a high likelihood of bias, if there were important inconsistencies in the results across studies, if there was uncertainty about the directness of evidence (including limited applicability of the findings to the population of interest), if the data were sparse (for example if there was only one study or if the results include just a few events or observations and were uninformative) or imprecise (for example the confidence interval [CI] spans a range greater than 1 or confidence limits are <0.5 to >2.0). The final grade for the quality of the evidence for an intervention–outcome pair was then assigned as high, moderate, low, or very low (see Table 40 in the original guideline document).

Grading the Overall Quality of Evidence

The quality of the overall body of evidence was then determined on the basis of the quality grades for all outcomes of interest, taking into account explicit judgments about the relative importance of each outcome. The resulting four final categories for the quality of overall evidence were A, B, C, and D (see the "Rating Scheme for the Strength of the Evidence" field).

See the original guideline document for assessment of net health benefit across all important clinical outcomes.

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

Overview of Process

The guideline development process included the following steps:

- Appointing Work Group members and the Evidence Review Team (ERT)
- Discussing process, methods, and results
- Developing and refining topics
- Identifying populations, interventions or predictors, and outcomes of interest
- Selecting topics for systematic evidence review
- Standardizing quality assessment methodology
- Developing and implementing literature-search strategies
- Screening abstracts and retrieving full text articles on the basis of predefined eligibility criteria
- Creating data extraction forms
- Extracting data and performing critical appraisal of the literature
- Grading the methodology and outcomes in individual studies
- Tabulating data from individual studies into summary tables
- Grading the strength of recommendations on the basis of the quality of evidence and other considerations
- Finalizing guideline recommendations and supporting rationales
- Sending the guideline draft for peer review to the Kidney Disease: Improving Global Outcomes (KDIGO) Board of Directors in January 2012 and for public review in May 2012
- Publishing the final version of the guideline

Collaboration Among Participants

The KDIGO Co-Chairs appointed the Work Group Co-Chairs, who then assembled the Work Group of domain experts, including individuals with expertise in internal medicine, adult and pediatric nephrology, diabetology/endocrinology, clinical chemistry, and epidemiology. The Tufts Center for Kidney Disease Guideline Development and Implementation at Tufts Medical Center in Boston, Massachusetts, USA, was contracted to conduct a systematic evidence review and provide expertise in guideline development methodology. The ERT consisted of physician–methodologists with expertise in nephrology, a project coordinator, a research assistant, and a medical writer–editor. The ERT instructed and advised Work Group members in all steps of literature review, critical literature appraisal, and guideline development. The Work Group and the ERT collaborated closely throughout the project.

The Work Group and its Chairs, KDIGO Co-chairs, ERT, and KDIGO support staff met for three 2-day meetings for training in the guideline development process, topic discussion, and consensus development.

Throughout the project, the ERT offered suggestions for guideline development and led discussions on systematic review, literature searches, data extraction, assessment of quality and applicability of articles, evidence synthesis, grading of evidence and guideline recommendations, and consensus development. The Work Group took the primary role of writing the recommendation statements and rationales and retained final responsibility for their content.

Defining Scope and Topics

This KDIGO CKD guideline was set out to update the KDOQI Clinical Practice Guidelines for CKD: Evaluation, Classification, and Stratification in 2002, which spans many topics related to the diagnosis, classification, stratification, and management of CKD.

The Work Group Co-Chairs prepared the first draft of the scope of work document as a series of open-ended questions to be considered by Work Group members. At their first 2-day meeting, members added further questions until the initial working document included all topics of interest to the Work Group. The inclusive, combined set of questions formed the basis for the deliberation and discussion that followed. The Work Group strove to ensure that all topics deemed clinically relevant and worthy of review were identified and addressed.

Updating the topics of definitions and classification was based on the output from the KDIGO Controversies Conference and the CKD Prognosis Consortium.

Additional topics that relate to explicit selection of diagnostic tests or interventions were chosen to undergo systematic review of the best available evidence. Systematic evidence review entails *a priori* question formulation, specification of important outcomes for the review, systematic searches, data extraction, tabulation, analysis, and synthesis of evidence and is described in detail for each of the specific questions.

The eight topics for which the ERT conducted searches and evidence review are shown in Table 37 of the original guideline document. For the systematic review topics, the Work Group and ERT further developed and refined each topic and specified screening criteria, literature search

strategies, and data extraction forms.

Many other topics were not suitable to be addressed by in-depth evidence review. When the anticipated outcome of an extensive literature search was unlikely to yield evidence that directly informs practice choices, the approach chosen was that of a narrative review.

The Work Group took on the primary role of writing the recommendations and rationale statements and retained final responsibility for the content of the guideline statements and the accompanying narrative. The ERT reviewed draft recommendations and grades for consistency with the conclusions of the evidence review.

Formulating Questions of Interest

Questions of interest were formulated according to the PICODD (Population, Intervention or Predictor, Comparator, Outcome, study Design, and Duration of follow-up) criteria. Details of the PICODD criteria are presented in Table 37 of the original guideline document.

Grading the Quality of Evidence and the Strength of Guideline Recommendations

A structured approach, based on the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach, was used to grade the quality of the overall evidence and the strength of recommendations for each topic. This grading scheme—with two levels for the strength of a recommendation together with four levels of grading for the quality of the evidence, as well as the option of an ungraded statement for general guidance—was adopted by the KDIGO Board in December 2008.

The strength of a recommendation indicates the extent to which one can be confident that adherence to the recommendation will do more good than harm. The process of transparently grading evidence and recommendations for treatment topics is described below in further detail. However, the approach had to be adapted for the main topics of the KDIGO chronic kidney disease (CKD) guideline because they were not treatment-related topics.

Rating Scheme for the Strength of the Recommendations

Nomenclature and Description for Grading Recommendations

	Implications		
Grade*	Patients	Clinicians	Policy
Level 1 'The Work Group recommends'	Most people in your situation would want the recommended course of action and only a small proportion would not.	Most patients should receive the recommended course of action.	The recommendation can be evaluated as a candidate for developing a policy or a performance measure.
Level 2 'The Work Group suggests'	The majority of people in your situation would want the recommended course of action, but many would not.	Different choices will be appropriate for different patients. Each patient needs help to arrive at a management decision consistent with her or his values and preferences.	The recommendation is likely to require debate and involvement of stakeholders before policy can be determined.

*The additional category 'Not Graded' was used, typically, to provide guidance based on common sense or where the topic does not allow adequate application of evidence. The most common examples include recommendations regarding monitoring intervals, counseling, and referral to other clinical specialists. The ungraded recommendations are generally written as simple declarative statements, but are not meant to be interpreted as being stronger recommendations than Level 1 or 2 recommendations.

Cost Analysis

The guideline developers reviewed published cost analyses.

Method of Guideline Validation

External Peer Review

Description of Method of Guideline Validation

Review Process

As with all Kidney Disease: Improving Global Outcomes (KDIGO) guidelines a two step process was used. This included a review by the Board of Directors, with feedback to the Work Group Chairs followed by revisions to the document. The public review, consisting of interested stakeholders from international communities, organizations and individuals, was then undertaken. The draft document was sent to a total of 2,320 external reviewers, with 293 responses received and tabulated. The feedback was carefully reviewed and where appropriate, suggested changes were incorporated into the final document. In the interest of transparency, the Work Group prepared individual responses to each reviewer comment and these will be posted on the KDIGO website.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

- Identification of people at earlier time points in the trajectory of chronic kidney disease (CKD), with appropriate management and earlier referral of those who would benefit from specialist kidney services, should lead to both economic and clinical benefits.
- If CKD is detected early, the associated complications and the progression to kidney failure can be delayed or even prevented through appropriate interventions.
- Targeting modifiable risk factors may both reduce cardiovascular disease (CVD) in people with CKD and reduce progression of CKD to end-stage renal disease.

Potential Harms

- Blood pressure (BP) lowering drugs are associated with electrolyte disorders, acute deterioration in kidney function, orthostatic hypotension.
- False-negative and false-positive results of tests

Refer to Table 32 in the original guideline document for cautionary notes for prescribing in people with chronic kidney disease (CKD). See Table 30 in the original guideline document for special considerations for bisphosphonates in CKD.

Contraindications

Contraindications

- Clodronate is contraindicated when glomerular filtration rate (GFR) is <10 ml/min/1.73 m².
- Risedronate is contraindicated when GFR is <30 ml/min/1.73 m².
- Tiludronate is contraindicated when creatinine clearance (CrCl) is <30 ml/min.

Refer to Table 32 in the original guideline document for cautionary notes for prescribing in people with chronic kidney disease (CKD).

Qualifying Statements

Qualifying Statements

Limitations of Approach

Although the literature searches were intended to be comprehensive, they were not exhaustive. MEDLINE was the only database searched. Hand searches of journals were not performed, and review articles and textbook chapters were not systematically searched. However, important studies known to domain experts that were missed by the electronic literature searches were added to the retrieved articles and reviewed by the Work Group.

Use of the Clinical Practice Guideline

- This Clinical Practice Guideline document is based upon systematic literature searches last conducted in June 2011, supplemented with additional evidence through November 2012. It is designed to provide information and assist decision making. It is not intended to define a standard of care, and should not be construed as one, nor should it be interpreted as prescribing an exclusive course of management. Variations in practice will inevitably and appropriately occur when clinicians take into account the needs of individual patients, available resources, and limitations unique to an institution or type of practice. Every health-care professional making use of these recommendations is responsible for evaluating the appropriateness of applying them in any particular clinical situation. The recommendations for research contained within this document are general and do not imply a specific protocol.
- The guideline will provide a blueprint for an approach to chronic kidney disease (CKD) care in an international context. While the guideline will be sensitive to issues related to ethnicity and also geographical considerations, it is expected that subsequent regional adaptation will be required for specific healthcare settings or contexts.
- This document is not intended to provide enough detail to replace training and education in nephrology, nor is it intended to serve as a textbook of medicine or nephrology.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Clinical Algorithm

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

End of Life Care

Living with Illness

Staying Healthy

IOM Domain

Effectiveness

Patient-centeredness

Identifying Information and Availability

Bibliographic Source(s)

KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease. *Kidney Int Suppl.* 2013 Jan;3(1):1-150. [729 references]

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2013 Jan

Guideline Developer(s)

Kidney Disease: Improving Global Outcomes - Nonprofit Organization

Source(s) of Funding

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Guideline Committee

Kidney Disease: Improving Global Outcomes (KDIGO) Chronic Kidney Disease Work Group

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Financial Disclosures/Conflicts of Interest

Kidney Disease: Improving Global Outcomes (KDIGO) makes every effort to avoid any actual or reasonably perceived conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the Work Group. All members of the Work Group are required to complete, sign, and submit a disclosure and attestation form showing all such relationships that might be perceived as or are actual conflicts of interest. This document is updated annually and information is adjusted accordingly. All reported information is published in its entirety at the end of the original guideline document in the Work Group members' Biographic and Disclosure Information section, and is kept on file at the National Kidney Foundation (NKF), former Managing Agent for KDIGO.

Guideline Status

This is the current release of the guideline.

Guideline Availability

Electronic copies: Available from the [Kidney Disease: Improving Global Outcomes \(KDIGO\) Web site](#) .

Availability of Companion Documents

The following are available:

- KDIGO clinical practice guideline for the evaluation and management of chronic kidney disease. Appendix 1. New York: Kidney Disease: Improving Global Outcomes; 2013 Jan. 7 p. Electronic copies: Available in Portable Document Format (PDF) from the [Kidney Disease: Improving Global Outcomes \(KDIGO\) Web site](#) .
- KDIGO clinical practice guideline for the evaluation and management of chronic kidney disease. Supplemental tables. New York: Kidney Disease: Improving Global Outcomes; 2013 Jan. 10 p. Electronic copies: Available in PDF from the [KDIGO Web site](#) .
- KDIGO CKD GL public review summary report. Electronic copies: Available in PDF from the [KDIGO Web site](#) .
- Methods for development of KDIGO clinical practice guidelines. Electronic copies: Available from the [KDIGO Web site](#) .

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on September 20, 2013. This summary was updated by ECRI Institute on April 15, 2016 following the U.S. Food and Drug Administration advisory on Metformin-containing Drugs.

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